

# Medical Social Networks, Epidemiology and Health Systems

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## INTRODUCTION

Pandemic crisis, location of the primary case and individual medical data are all major concerns and features in the global health environment. Pandemic crisis, *i.e.*, an epidemiological outbreak that is simultaneously on several continents, with all the social, economic and individual mayhem it provokes, links tightly with the location of the primary case, which is the individual who introduces the disease into the population, and whose clinical data, *i.e.*, the genetic and personal health related data, may prove invaluable to assess the global health policies and countermeasures on the crisis.

These three aspects are among some of the Health and Social problems that the emerging medical social networks can positively address. Medical networks, which work as an interface between the patient medical data and his/hers geographical and/or social connections, as well as between the patient's individual needs and the attending medical doctor, can allow feasible and fast visualization/information systems. Furthermore, they are effective and emerging research tools in studying health policies and detecting how to improve them.

In the recent five years, there has been an increased research interest in the development and application of informal medical social networks, as well as data concerning the real advantages of their use on daily situations and Health Policies Implementation. In 2018, an ideal model for a medical social network and data visualization information system has been proposed (Gonçalves, Moura, Cordeiro & Campos, 2018), which considers both the individual and the socio-economic needs and rights, and it is likely that the first prototypes can be presented in the near future.

This chapter reviews the evolution and *status quo* of prospective medical social networks, and discusses the ideal model and its future venues and interaction with ethics in the areas of Economics, Health Policies and Human Rights.

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## BACKGROUND

The advent of the concept ‘medical social network’ came in 2007, when Barabási published a work entitled *Medicine Network: From Obesity to the “Diseasome”* (Barabási, 2007). Though Barabási used the term ‘medicine network’ instead of ‘medical social network’, he defended that since networks can be found on every particulars and features of human health, as knowledge regarding its effects on the patients’ biomedical aspects increased, a new field of expertise on medical practice and research would appear. These medical social networks were constructed and studied through graph theory visualization, namely as nodes and edges (Newman, 2010).

A node, within a social network, is defined as a distinct entity, which can be single, like a person or a molecule, or collective, like a country or a company. An edge, in the same context, represents the connection between two different nodes. The connections are multi-natured, *i.e.*, they can be friendship or working connections, for example, if one thinks of human individuals; but they can also be of chemical definition, for example, as the bond type between intramolecular atoms. Exemplifying, when restricting to the medical context, the nodes may represent people, coupled by their biological or psychological factors, such as obesity (Christakis & Fowler, 2009) or depression (Rosenquist, Fowler, & Christakis, 2011), but they can also represent diseases themselves, like in comorbidity studies, *i.e.*, the causal interaction between diseases (Folino, Pizzuti & Ventura, 2010). In the same context, the edges are the type of connections between the people, *i.e.*, genetic/familiar or geographical, or different causal levels of comorbidity, if the nodes are diseases. These simple examples do not exempt the graph model to have added complexity, since the nodes can also comprise the information of gender, for instance, apart from the genetic or otherwise bio, social, or psychological factors. Figure 1 illustrates in a simplified manner the relation between real interactions and corresponding graphs.

Figure 1. Example of a multi-layer social network representing real life connections between people. (Image obtained with software MuxViz(De Domenico, Porter & Arenas, 2015).)

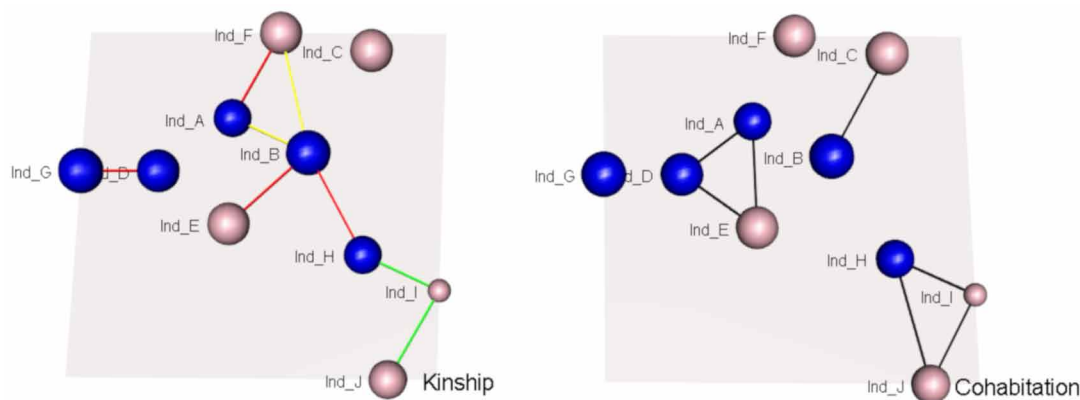


Figure 1 represents a social network with two layers. The left, or first, layer represents the kinship between the nodes, which are individuals, and the right, or second, layer represents cohabitation connections. The pink nodes represent female individuals and the blue nodes represent males. The size of the nodes is proportional to the age of the individual, and in the left layer, the edge colour represents different kinds of family connections. Yellow stands for grandparent/grandchild connection, green stands for

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